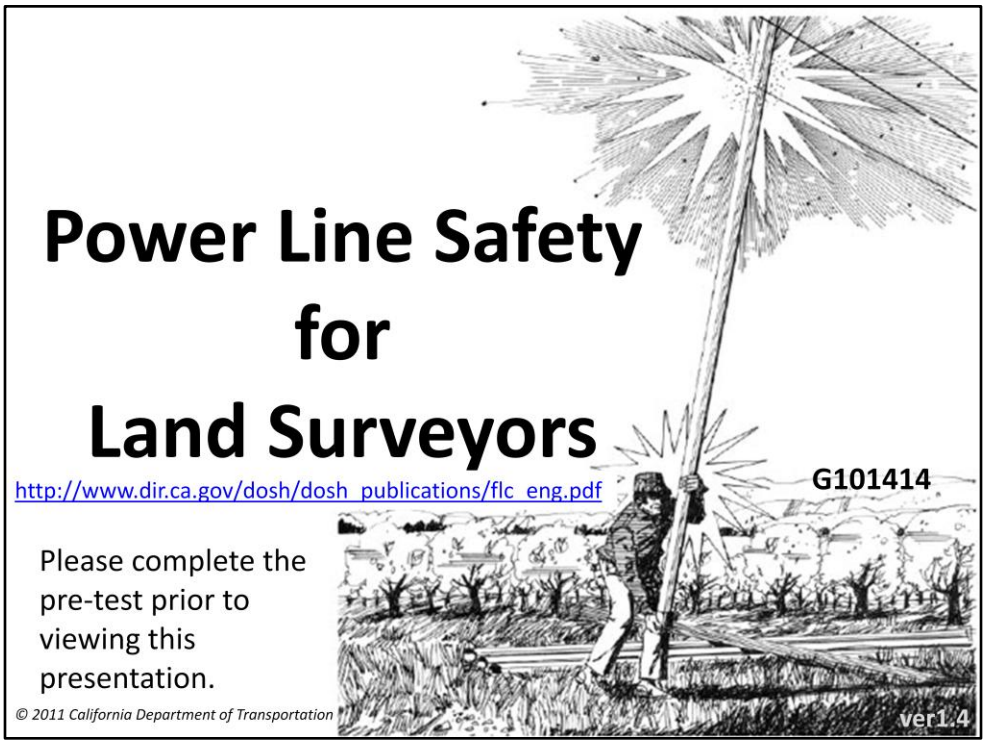


Welcome to Power Line Safety for Land Surveyors.

Please complete the pre-test prior to this presentation.

After completing this session, you will have an understanding of the hazards, risks, and laws associated with working near power lines, and the knowledge and training for you to make sound decisions to ensure your safety, and the safety of your co-workers, in the vicinity of power lines.

According to the Department of Industrial Relations, historically, electrocution is the second leading cause of fatal injuries in California agriculture. In a recent year, 80% of agricultural fatalities were electrocutions. (See hyperlink for more information).

While far and away the most serious hazard faced by field survey crews is the danger posed by working close to live traffic, there are many other potential hazards that can be encountered working in the field.

Let's examine why electricity is so dangerous and a hazard to your health if not avoided.

Electricity Basics

- Electricity is energy resulting from the motion of charged particles (electrons).

- Amperage (E) also known as current is the number of electrons in motion.

- **Amperage or current does the work or causes the damage!**

http://science.howstuffworks.com/electricity.htm

Let's start with a review of basic electricity concepts.
Electricity is a form of energy resulting from the motion of charged particles commonly called electrons. Electricity flows from a higher level to a lower level through a conductor.

"Amperage" also known as "current" is the number of electrons in motion. **Amperage or current is what does the work, or in the case of electric shock or electrocution, causes the damage.**

The unit of measure for amperage or current is "amps"
1 amp is 6.24 x 10 to the 18^{th} electrons per second.
1 milliamp is $1/1000^{th}$ of an amp

Electricity Basics

- Voltage (I) can be considered the "pressure" pushing electrons along.
- Resistance (R) is a load or restriction of the flow of electrons.
- Ohm's Law: E = I / R or
Current = Voltage / Resistance

http://science.howstuffworks.com/electricity.htm

If we think of current as electron flow, Voltage is the measure of electrical force, and can be considered the "pressure" pushing electrons along. Of course the unit is "volts." 1,000 volts is 1kV.

Resistance is a load or restriction of the flow of electrons. Place a load or resistance in a circuit, and the current from a source of electricity will provide power to the load, performing whatever work you desire – motion, light, heat, etc. The resistance unit is "ohms"

Ohm's Law is Current = Voltage / Resistance

For a given resistance, the higher the voltage, the higher the current. And, for a given voltage, the lower the resistance, the higher the yielded current.

Electricity Basics

- Electricity needs a complete or closed circuit to effectively flow
- Electricity always seeks its lowest level or ground. It may flow from higher voltage to a lower voltage source.
- Electricity will travel any path it can as it seeks a ground – possibly through you!

http://www.allaboutcircuits.com/vol_1/chpt_3/2.html

Electricity needs a complete or closed circuit to flow.

Electricity always seeks its lowest level or ground.

It will travel any path it can as it seeks a ground. **If you make contact with an open circuit and the ground, or a higher voltage wire and a lower voltage wire, YOU complete the circuit and become a conductor allowing the current to flow.**

Voltage will be a given quantity in each situation, so, how much resistance does the typical human body provide?

Resistance varies significantly depending on how strong the connection is between the conductor and the body, and men typically offer much higher electrical resistance than women.

Ohm's Law and the Human Body

- A man holds contacts loosely between dry fingers: resistance ~ 1,000,000ohms.
- Water sprinkled on the man's fingers to simulate sweat, and hand-to-hand resistance is reduced to ~ 17,000 ohms.
- A tighter grip reduces resistance.

http://www.allaboutcircuits.com/vol_1/chpt_3/2.html

A man holds contacts loosely between dry fingers, resistance is approximately 1,000,000 ohms.

With wet fingers loosely holding contacts, his resistance is reduced to approximately 17,000 ohms.

Bear in mind this is a typical man loosely contacting a thin metal wire with only two fingers of each hand. Hold tight and resistance is reduced allowing more current to flow.

Also, The muscles that cause our fingers to grip are much stronger than those that extend our fingers. An electric shock causes muscles to contract. This causes the hands to clench on a conductor, improving the conductivity by reducing resistance, allowing even more current to flow.

Ohm's Law and the Human Body

•Ohm's Law: E = I / R or
Current = Voltage / Resistance

Given: I = 12,000 volts AC at 60 Hz.
Dry hands so R ~ 1,000,000 ohms

Solve for E or current in milliamps:

http://www.allaboutcircuits.com/vol_1/chpt_3/2.html

Let's do some easy math…

Ohm's Law: E = I / R or Current equals Voltage divided by Resistance

Residential area pole to pole (distribution) power lines are typically between 600 and 69,000 volts.
Let's use 12,000 volts.

Given the resistance for a man with dry hands of approximately 100,000 ohms,
and a voltage of 12,000, or 12 kV.

What is the current yield in milliamps?

Ohm's Law and the Human Body

Current = 12,000 volts / 1,000,000 ohms
Times 1000 milliamps /amp = **12mA**

Current = **12 milliamps (mA) if you are dry and clean at 12,000 volts**

What happens if you are wet or dirty?

http://www.allaboutcircuits.com/vol_1/chpt_3/2.html

Current = 12,000 volts divided by 1 million ohms, times 1000 milliamps/amp = 12 mA.

12 milliamps if you are dry and clean at 12,000 volts

That doesn't sound like much, does it?

What happens if you are wet or dirty?

You offer less resistance and are a better conductor!

Ohm's Law and the Human Body

•Ohm's Law: E = I / R or
Current = Voltage / Resistance

Given: I = 12,000 volts AC at 60 Hz.
Man with wet hands so R ~ 17,000 ohms

Solve for E or current in milliamps:

http://www.allaboutcircuits.com/vol_1/chpt_3/2.html

Wet or dirty:

Ohm's Law: Current equals Voltage divided by Resistance.

Given 12,000 volts and a man's wet fingers loosely holding contacts, so resistance is only approximately 17,000 ohms.

What is the current yield in milliamps?

Ohm's Law and the Human Body

Current = 12,000 volts / 17,000 ohms

Times 1000 milliamps /amp = **706 Ma**

Current = **706 mA!**

Even "low" voltage can yield nearly 13 mA when wet or dirty:

Current = 220 volts / 17,000 ohms

Current = **12.9 mA**

How much current can the typical human body take?

http://www.allaboutcircuits.com/vol_1/chpt_3/2.html

12,000 volts divided by 17,000 ohms, times 1000 milliamps/amp = 706 mA.

706 milliamps from that same 12kV line!

Even if the voltage is only from a 220 volt residential circuit the yield is nearly 13 milliamps when wet or dirty.

Still, these values are in milliamps. Doesn't that sound like a negligible amount?

How many amps is the circuit protection from a typical household circuit breaker? **15 amps?**

How much current can the typical human body take?

Effect of Current on a Human Body

E = I / R or Current = Voltage / Resistance

BODILY EFFECT	DIRECT CURRENT	60 Hz AC	10 kHz AC
Slight sensation felt at hand(s)	Men = 1.0 mA Women = 0.6 mA	0.4 mA 0.3 mA	7 mA 5 mA
Threshold of perception	Men = 5.2 mA Women = 3.5 mA	1.1 mA 0.7 mA	23 mA 15 mA
Painful, but voluntary muscle control maintained	Men = 62 mA Women = 41 mA	9 mA 6 mA	55 mA 37 mA
Painful, unable to let go of wires	Men = 76 mA Women = 51 mA	**16 mA** **10.5 mA**	75 mA 50 mA
Severe pain, difficulty breathing	Men = 90 mA Women = 60 mA	**23 mA** **15 mA**	94 mA 63 mA
Possible heart fibrillation after 3 seconds	Men = 500 mA Women = 500 mA	**100 mA** **100 mA**	

http://www.allaboutcircuits.com/vol_1/chpt_3/2.html

Very little current is necessary to manifest harmful effects on the human body. Electric shock can result in internal and external injury, such as burns, to body parts or the entire body – often resulting in death. After receiving a "jolt" of electricity, all or part of the body may be temporarily paralyzed or involuntarily move which may cause loss of grip or stability, and result in a fall.

Men typically offer higher electrical resistance than women, so it takes higher voltage for men to feel comparable effects.

Between 10 and 16 milliamps of 60Hz AC power can cause pain, and make you unable to release whatever you are holding to break contact.

Pain is severe between 15 and 23 milliamps, and can cause difficulty breathing, 30 mA can cause respiratory paralysis.

100 milliamps can cause heart fibrillation after 3 seconds.

100 milliamps is only 1/10th of an amp!

Let's discuss how we can work safely and avoid being electrocuted in the field and becoming a victim.

Overview of Procedures & Requirements

- Plan work before going to the field.
- Recon the area upon arrival at the jobsite.
  - Identify, Discuss, & Document Hazards.
  - Discuss special circumstances (vaults, substations, etc.) with your supervisor.

We will discuss the following Procedures & Requirements in the slides ahead:

- Plan the work before going to the field…

- Recon the area upon arrival at the jobsite…
  - Identify, Discuss, & Document Hazards
  - Discuss special circumstances with your supervisor and/or Senior prior to entering or being in close proximity to electrical Sub-Stations, open cabinets or vaults, light-rail overhead power lines, etc.

Overview of Procedures & Requirements

- Work in Conformance with Power Line Safety Laws/Regulations
- Prior to extending any rod through tree canopy, ensure area above is hazard free
- Conduct Power Line Safety and Electrical Emergencies training annually

•Work in Conformance with Power Line Safety Laws/Regulations

•Prior to extending any rod through tree canopy, ensure area above is hazard free

•Conduct Power Line Safety and Electrical Emergencies training annually

Plan the work before going to the field

- Review the request with the requestor
- Understand the purpose of the survey and the requestor's needs
- Consult available resources in the office to help plan your work and identify potential hazards
- Consider the equipment available

Plan the work before going to the field:

Review the Survey Request with the requestor. If power lines are present, determine the voltage.

Fully understand the purpose of the survey requestor's needs.

For Requests for Construction Staking, make sure the area is ready for stakes. Clearing and grubbing stakes may first be needed if hazards are present.

Consult available resources to help you plan your work and identify potential hazards.

Consider the equipment available to you.

Recon the area upon arrival at the jobsite

- Identify and discuss all hazards before beginning work
- Discuss special circumstances with your supervisor – Sub-stations, vaults, etc.
- Document the safety meeting.
- If conditions change, recon, identify hazards, discuss, and document again.

Recon the area upon arrival at the jobsite –

Identify and discuss all hazards with all crewmembers. Plan your instrument setup locations as needed to reduce workers' exposure to hazards.

Discuss special circumstances with your supervisor – Electrical Sub-Stations, open vaults or cabinets, and light-rail overhead power lines should be treated with at least the same reverence as power lines.

Document all tailgate safety meetings.

If conditions change, recon, identify hazards, and discuss again, and of course document another safety meeting.

Recon the area upon arrival at the jobsite

- Consider ALL power lines energized
- Maintain awareness of power lines at all times
- Work in conformance with applicable power line safety regulations and procedures

Consider ALL power lines as energized - Consider any wire between poles or from a pole to a building to be energized with high voltage!

Staff must maintain awareness of power line locations at all times.

Work in conformance with applicable power line safety regulations and Department procedures.

Work in Conformance with Safety Regulations

- What safety regulations control operations near power lines?
- What are the requirements? Are there different types of requirements?
- Do we just need to not touch power lines or are there minimum separation requirements?

What safety regulations control operations near power lines?

What are the requirements? Are there different types of requirements?

Do we just need to not touch power lines or are there minimum separation requirements?

Power Line Safety Law

California Division of Occupational Safety and Health Title 8 Regulations, Chapter 4. Division of Industrial Safety, Subchapter 5. Electrical Safety Orders, Group 2. High-Voltage Electrical Safety Orders, Article 37. Provisions for Preventing Accidents Due to Proximity to Overhead Lines
§2946. Provisions for Preventing Accidents Due to Proximity to Overhead Lines.
http://www.dir.ca.gov/Title8/2946.html

Power line safety – it's not just a good idea, it's the law – The law is printed in your PDFs so you have a copy, and you can also find it in the California Code of Regulations.

All work around overhead power lines shall be conducted in accordance with…

California Division of Occupational Safety and Health Title 8 Regulations, Chapter 4, Subchapter 5, Article 37, **Section 2946** Provisions for Preventing Accidents Due to Proximity to Overhead Lines.

Provisions for Preventing Accidents Due to Proximity to Overhead Lines.

§2946 (a) General. **No person, firm, or corporation, or agent of same, shall require or permit any employee to perform any function in proximity to energized high-voltage lines; to enter upon any land, building, or other premises and there engage in any** excavation, demolition, construction, repair, or other **operation**;

This is what the law says:

What does this mean?

Don't require **or allow** staff to work in close proximity to power lines.

Continued on next slide…

Provisions for Preventing Accidents Due to Proximity to Overhead Lines.

§2946 (a) *continued* - **or** to erect, install, **operate**, or store in or upon such premises **any tools**, machinery, equipment, materials, or structures (including scaffolding, house moving, well drilling, pile driving, or hoisting equipment) **unless and until danger from accidental contact with said high voltage lines has been effectively guarded against.**

What does this mean?
Keep away from power lines unless the danger has been effectively guarded against.

How do you effectively guard against the danger of accidental contact?
Maintain awareness of your location with respect to power lines. Ensure that you will not make accidental contact or encroach on the applicable minimum safety distance of the power lines.

Power Line Safety Law

§2946. (b) Clearances or Safeguards Required. **Except where overhead electrical distribution and transmission lines have been de-energized and visibly grounded, the following provisions shall be met:**

Unless the lines "have been de-energized and visibly grounded," you must meet the provisions on the following slides:

Do you have the expertise to know when a line is not energized and grounded?

Probably not, so let's just meet the following provisions.

Power Line Safety Law

§2946. Provisions for Preventing Accidents Due to Proximity to Overhead Lines.

(b) (1) Over Lines. **The operation**, erection, **or handling of tools**, machinery, **apparatus**, supplies, or materials, **or any part thereof, over energized overhead high-voltage lines shall be prohibited.**

What does this mean?

No working or using tools **above** energized overhead high-voltage lines.

Power Line Safety Law

§2946. (b) (2) **The operation**, erection, handling, or transportation **of tools**, machinery, materials, structures, scaffolds, or the moving of any house or other building, **or any other activity where any parts of the above or any part of an employee's body will come closer than the minimum clearances from energized overhead lines as set forth in Table 1 shall be prohibited.**

What does this mean?

No working or using tools within certain distances of energized overhead high-voltage lines – Distances depend on the voltage – **See Table 1**

Power Line Safety Law

§2946. (b) (3) Boom-type lifting or hoisting equipment. **The erection, operation or dismantling of any boom-type lifting or hoisting equipment, or any part thereof, closer than the minimum clearances from energized overhead high-voltage lines set forth in Table 2 shall be prohibited.**

What does this mean?
No Boom-type lifting or hoisting equipment operations within certain distances of energized overhead high-voltage lines – Again - distances depend on the voltage – **See Table 2**

Why do we need to be concerned about boom-type lifting and hoisting equipment? We don't use them…
Often a person nearby on the ground is the one electrocuted when power lines are knocked down or slung loads contact or arc to power lines. If a crane or boom truck operator is too close to lines, get away!

Power Line Safety Law

§2946. (b) (4) Storage. **The storage of tools**, machinery, **equipment**, supplies, materials, **or apparatus under, by, or near energized overhead high-voltage lines is hereby expressly prohibited if at any time during such handling or other manipulation it is possible to bring such tools**, machinery, **equipment**, supplies, materials, **or apparatus, or any part thereof, closer than the minimum clearances from such lines as set forth in Table 1.**

What does this mean?

Don't store anything near power lines where it could encroach on the Table 1 separation requirements in handling.

Power Line Safety Law

§2946. (c) **The specified clearance shall not be reduced** by movement due to any strains impressed (by attachments or otherwise) upon the structures supporting the overhead high-voltage line or upon any equipment, fixtures, or attachments thereon.

What does this mean?

Don't consider that you can reduce the clearance by pulling or flexing the power line supports away from the work area – Not something we would do anyway, but it is specifically mentioned in the law. Watch out for contractors or others with equipment doing this.

Power Line Safety Law

§2946. (d) **Any overhead conductor shall be considered to be energized** unless and until the person owning or operating such line verifies that the line is not energized, and the line is visibly grounded at the work site.

What does this mean?
Consider all lines energized!
Do you have the expertise to know when a line is not energized and grounded?

Table 1

General MINIMUM Clearances Required

Nominal Voltage		MINIMUM Clearance
600 volts	to 50,000	6 feet
over 50,000	to 345,000	10 feet
over 345,000	to 750,000	16 feet
over 750,000	to 1,000,000	20 feet

http://www.dir.ca.gov/Title8/2946.html

- Boom-type lifting or hoisting equipment clearances are much greater.
- The Caltrans Safety Manual (8.41) requires a minimum clearance of 3 feet at all times around low voltage power lines (less than 600 volts)

http://onramp.dot.ca.gov/hq/maint/mset/Ch8_2010_Sept_and_T-Plates_01-24-11.pdf

Why do we need to remain clear of power lines rather than just not touching them?
Insulation on wires can deteriorate over time and crack, allowing electricity to arc from the wire.

These are MINIMUM required clearances – MORE clearance is BETTER.

We will see on the next slide that boom-type lifting or hoisting equipment clearances are much greater.

The Caltrans Safety Manual, Section 8.41, requires a minimum clearance of 3 feet at all times around low voltage power lines (less than 600 volts). This would be typical for service connections.

Table 2

Boom-type lifting or hoisting equipment
MINIMUM clearances required

Nominal Voltage		MINIMUM Clearance
600 volts	to 50,000	10 feet
over 50,000	to 75,000	11 feet
over 75,000	to 125,000	13 feet
over 125,000	to 175,000	15 feet
over 175,000	to 250,000	17 feet
over 250,000	to 370,000	21 feet
over 370,000	to 550,000	27 feet
over 550,000	to 1,000,000	42 feet

http://www.dir.ca.gov/Title8/2946.html

AGAIN - These are MINIMUM required clearances – MORE clearance is BETTER.

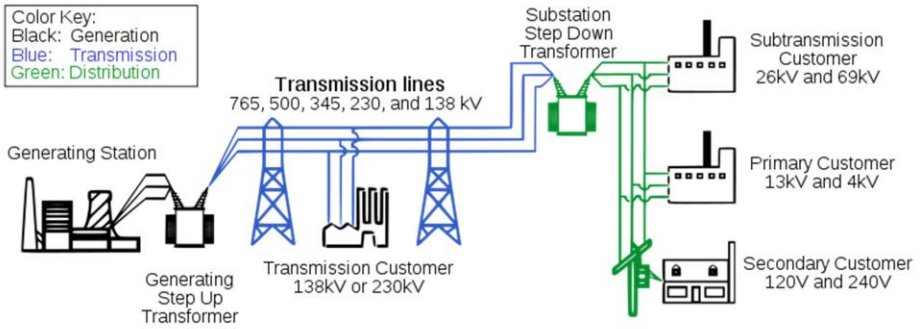
Why do we care about boom-type lifting or hoisting equipment clearances? We don't use this equipment.

Often a person nearby on the ground is the one electrocuted when power lines are knocked down or slung loads contact or arc to power lines.

Be aware of equipment operators operating too closely to power lines. If a crane, hoist, or boom truck operator is too close to lines, get away and notify the operator if possible!

Basic Structure of the Electric System

Classification	Nominal Voltage	Clearance[1]
Transmission	Over 69kV	11’ or more
Distribution	120 volts to 69kV	6’ to 10‘

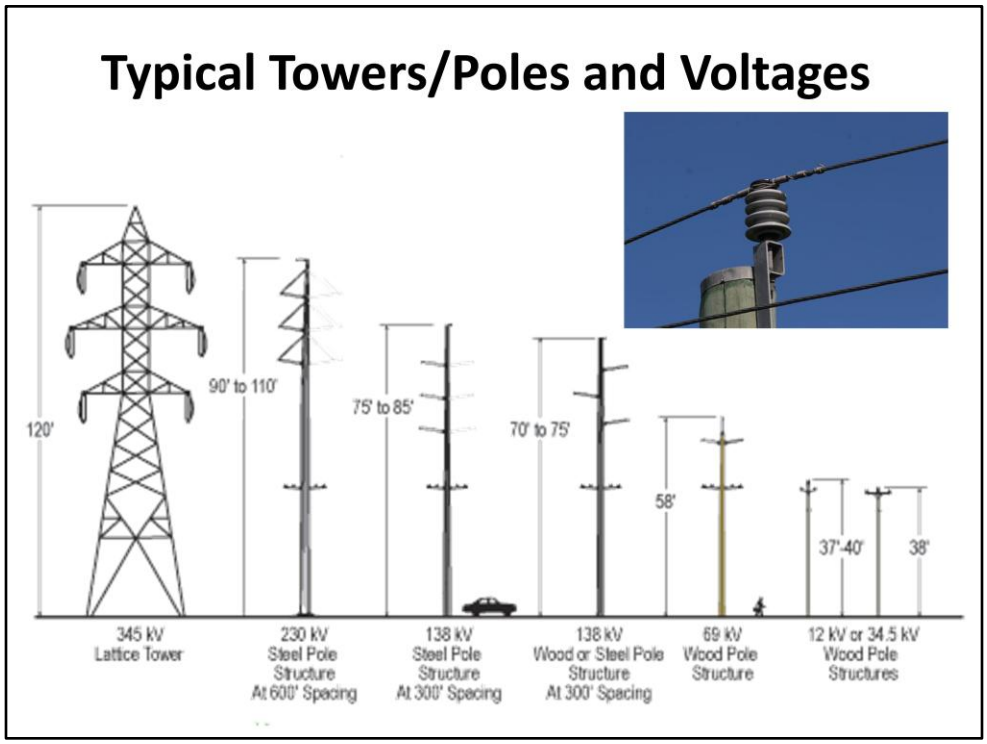


http://www.ferc.gov/industries/electric/indus-act/reliability/blackout/ch1-3.pdf

http://www.pge.com/mybusiness/edusafety/systemworks/electric/currentgrid/

The basic structure of the electric power grid is shown on this slide.

Classification terms such as Transmission and Distribution are indicators of the approximate voltage of a line. If the classification is all you have to go by to determine the voltage and therefore the appropriate clearances, be sure to exceed the statutory requirements.



This chart can help you roughly identify power line voltage ranges.

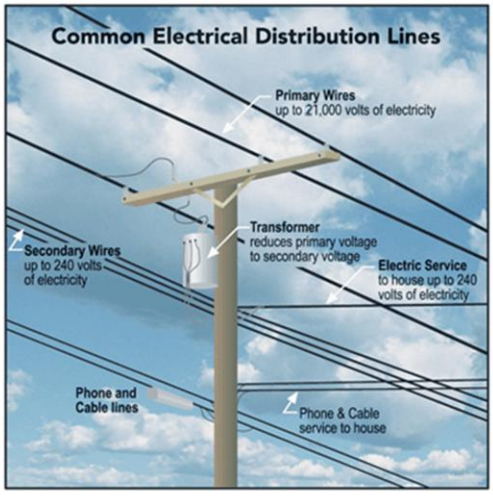
Another rule of thumb is to count the number of mushroom shaped insulators between the line and the structure that holds the line. If there are more than three such insulators, it is likely to be a transmission line – over69kV. If there are around 7-12 insulators, the line probably carries 115 kV. Twelve or more suggests the line carries more than 300 kV.

If this is all you have to go by to determine appropriate clearances, be sure to exceed the statutory clearance requirements.

Transmission Towers **Distribution Pole**

Nominal Voltage?

MINIMUM Clearance per §2946 Table 1?



What is the nominal voltage of, and appropriate clearance from a Transmission Tower or pole? Transmission Tower and pole Nominal Voltage = 69kV to 1,000kV

MINIMUM Clearance per §2946 Table 1 = 10', 16' or 20' voltage dependent

What is the nominal voltage of, and appropriate clearance from a Distribution Pole?
Distribution Pole Nominal Voltage = 120 volts to 69kV

MINIMUM Clearance per §2946 Table 1 = 6' or 10' voltage dependent

Tree Canopy

- Prior to extending any rod or pole through a tree or vegetation canopy, ensure the area above is hazard free.
- This includes prism poles, leveling rods, range poles made of **ANY** material.
- Fiberglass rods may still conduct electricity due to moisture or dirt on the rod.
- Refer to warning labels - ensure they are affixed to rods and legible.

Prior to extending any rod through a tree or vegetation canopy, ensure the area above is hazard free.

This includes prism poles, leveling rods, and range poles of any material.

Fiberglass rods may still conduct electricity due to moisture or dirt on the rod.

Refer to warning labels - ensure they are affixed to rods and legible.

Thunder and Lightning Storms

- If you can hear thunder, you are within striking distance of lightning.
- Stop working and take shelter in a grounded building or enclosed vehicle.
- If caught outside in an open field during a lightning storm, crouch down.
- Lay metal objects, prism poles, leveling rods, or range poles of **ANY** material on the ground far away from you.

http://www.dot.state.fl.us/surveyingandmapping/Manuals/safety.pdf

If you can hear thunder, you are within striking distance of lightning.

Stop working and take shelter in a grounded building or an enclosed vehicle if possible.

If caught outside in an open field during a lightning storm, crouch down and lay metal objects, prism poles, leveling rods, or range poles of **ANY** material on the ground far away from you.

Electrical Emergencies

If a Power Line is down:

- Stay far away from it!
- Call 911 and report it immediately.
- Who, what, where, and when.
- Keep away from anything that is touching the line, like water, a tree or a fence. They too may become energized.
- Keep others away from the power line or anything that is touching the line!

http://www.crh.noaa.gov/oax/safety/winterpower.php

If a Power Line is down:

•Stay far away from it!

•Call 911 and report it immediately.

•Who, what, where, and when.

•Of course report it to your supervisor as soon as you are able, and if you are on a construction project, notify the RE also.

•Keep away from anything that is touching the line, like water, a tree or a fence. They too may become energized.

•Keep others away from the power line or anything that is touching the line!

If a power line has fallen on a vehicle:

- Occupants should stay inside, unless more pressing danger (vehicle fire) exists.
- If they must exit the vehicle, jump away so that they do not touch the vehicle and ground at the same time.
- Keep feet together and shuffle or hop away from the area avoiding power lines.
- Keep people outside from touching the vehicle.

http://www.pge.com/microsite/safety_esw_ngsw/esw/emergency/car.html

This could happen in a motor vehicle or construction equipment accident.

•Occupants should stay inside, unless more pressing danger (such as vehicle fire) exists.

•If they must exit the vehicle, jump away so that they do not touch the vehicle and ground at the same time.

•Keep feet together and shuffle or hop away from the area avoiding power lines. **Why? Taking big steps with feet far apart can provide a path of electricity to flow from a highly energized area of the ground up one leg and down the other to an area of the ground having lower voltage.**

•Keep people outside from touching the vehicle.

If someone has been shocked

- Call 911 and report it immediately.
- Who, what, where, and when.
- Visually check the distance between their body and the power line – remember to comply with separation requirements.
- If able, determine if they are still in contact with the power line or anything that is touching the line (water, tree, fence, etc.).
- **Do not expose yourself to the same danger!**

http://www.pge.com/microsite/safety_esw_ngsw/esw/emergency/car.html

•Call 911 and report it immediately.
•Who, what, where, and when.
•Visually check the distance between their body and the power line – remember to comply with separation requirements.
•If able, determine if they are still in contact with the power line or anything that is touching the line (water, tree, fence, etc.).
•**Do not expose yourself to the same danger!**

•In 2011, three members of a Southern California family were all electrocuted by a downed power line. The first victim went outside the house to investigate the downed power line and was electrocuted. The second victim attempted to aid the first, and the third attempted to aid the first and second. The father, mother and son all died.

Do not expose yourself to the same danger!

If someone has been shocked – call 911

If NOT in contact with the power line:
- Check pulse
- Check breathing
- Perform first aid or CPR as needed
- Keep them warm
- Keep talking to them

If STILL in contact with the power line:
- Stay back
- Do not touch them
- Do not move the line
- Secure the area
- Wait for emergency personnel/rescue staff

Do not expose yourself to the same danger!

http://www.pge.com/microsite/safety_esw_ngsw/esw/emergency/car.html

If NOT in contact or if in contact – there are major differences in what you do.

Be sure to maintain required separation from power lines.

Again - Do not expose yourself to the same danger!

Power Line / Electrical Safety Meeting

- Discuss Power Line Safety and Electrical Emergencies annually at a safety meeting.

- Document the safety meeting appropriately.

Here is a topic that we can revisit each year.

Discuss Power Line Safety and Electrical Emergencies annually at a safety meeting.

Of course, document the safety meeting appropriately.

Power Line Safety Recap

- Plan the work before going to the field.
- Recon the jobsite before beginning work.
- Identify and discuss all hazards.
- Discuss special circumstances with your supervisor
- Document the safety meeting.

Continued on next slide

Recap:
Plan the work before going to the field.

Recon the jobsite – Identify and discuss all hazards with all crewmembers BEFORE starting work.

Discuss special circumstances with your supervisor and/or Senior prior to entering or being in close proximity to electrical Sub-Stations, open cabinets or vaults, Light-rail overhead power lines, etc.

Document the safety meeting.

Power Line Safety Recap – Cont.

- Consider ALL power lines as energized.
- Maintain awareness of power lines.
- Maintain required clearance from power lines – more clearance if the line is higher voltage.
- Use extreme caution when using tall rods, especially 25 foot rods.

Continued on next slide

Consider ALL power lines as energized.

Maintain awareness of power lines at all times.

Maintain required clearance distances from power lines

How much clearance? – a MINIMUM of 6 feet for lines over 600 volts – MORE clearance is required if power lines are higher voltage. Refer to table 1 or 2 as appropriate.

How much clearance for lines less than 600 volts?

For power lines under 600 volts, maintain at least 3 feet clearance at all times.

Use extreme caution when using tall rods, especially 25 foot rods.

Fiberglass rods may still conduct electricity due to moisture or dirt on the rod.

Power Line Safety Recap – Cont.

- Do not extend rods through a tree canopy unless you are certain it is clear above
- Conduct and document Power Line Safety & Electrical Emergencies training annually
- Remember –
  Safety is everyone's responsibility.

Do not extend rods through a tree canopy unless you are certain it is clear above.

Conduct and document Power Line Safety and Electrical Emergencies training annually.

Remember –

Safety is everyone's responsibility.

Power Line Safety

Additional safety information:

http://www.oshatrain.org/courses/studyguides/715studyguide.pdf

http://www.osha.gov/SLTC/electrical/construction.html

http://www.humboldtrec.coop/othersites/ElectricalSafety/index.html

http://www.bcnv.org/firedepartment/pdfresources/lightning%20safety%201.pdf

http://www.pgesafetyeducation.com/

http://www.pgesafetyeducation.com/contractor/look_up/index.html

http://www.pgesafetyeducation.com/contractor/trainers/slideshows/pdfs/PGE_CB_combo_Eng_notes.pdf

http://www.pgesafetyeducation.com/contractor/quiz/index.html

Any questions or comments?

Additional information is available at the following links:

Share this info with your family. The third link has an on-line power safety game suitable for both adults and kids.

Any questions or comments?

Please complete the post-test now.